

DESCRIPTIONS OF LARVAL CARABIDAE I.<sup>1</sup>RAYMOND G. THOMPSON AND ROBERT T. ALLEN<sup>2</sup>

Research Assistant and Associate Professor (respectively),  
Entomology Department, University of Arkansas,  
Fayetteville, AR 72701

## ABSTRACT

Descriptions and illustrations are provided for the following species: *Notiophilus novemstriatus* Say, *Pasimachus elongatus* Lec., *Agonum punctiformis* Say, and *Chlaenius prasinus* Dej. They are compared with other known larvae in each respective genus.

Many species belonging to the beetle family Carabidae are important predators of other arthropods, but it has been impossible to carry out complete ecological studies on the group because most larvae have not been described and are therefore unidentifiable. For several years, studies on many aspects of the ecology and biology of Carabidae have been in progress in Arkansas. During this time, the authors have attempted to rear field collected larvae in order to associate immature stages with adults. In this paper, larvae of *Notiophilus novemstriatus* Say, *Pasimachus elongatus* Leconte, *Agonum punctiformis* Say, and *Chlaenius prasinus* Dejean are described and compared with previously described species in the genus where possible.

## METHODS AND MATERIALS

All larvae were tentatively identified to genera with the aid of Van Emden's (1942) key. Identifications were correct in each of the cases where larvae were eventually reared to the imago. All measurements were made with an ocular micrometer in a stereoscope. All descriptions were taken from third instar larvae unless otherwise stated.

## COLLECTING DATA

Larvae collected in pitfall traps in a loblolly pine wood lot on the Arkansas Agricultural Experiment Station's main farm, Washington County, Arkansas, were identified as belonging to the genus *Notiophilus*. Numerous adults of *N. novemstriatus* were also collected in these traps. This is the only species in the genus that has been collected in Arkansas. No larvae were reared to adult, but we assume they are *N. novemstriatus*. The pitfall traps were in continuous operation for an entire year. Larvae were collected on the following dates in 1971: (number of larvae in parentheses) March 25(6): April 9(3), 16(1), 26(12), 30(2); May 7(5), 10(8), 20(5), 28(2).

<sup>1</sup>This research was supported by Cooperative Agreement No. 12-14-100-10, 644(33) with the United States Department of Agriculture, and published with approval of Director, Arkansas Agricultural Experiment Station, Fayetteville, Arkansas.

<sup>2</sup>We thank Sarah McCuisiton for preparing the illustrations.

In the case of the following 3 species, *P. elongatus*, *A. punctiformis* and *C. prasinus*, not all larvae collected were reared to the adult stage. The unreared larvae were identified by comparing them with the exuviae of reared specimens and also with live larvae that were eventually reared to the adult stage.

*P. elongatus* larvae were collected at 3 localities. The 1 larva reared to adult was collected by hand under a rock in a grassy meadow on 8 May 1970, on the Wichita National Wildlife Refuge near Lawton, Oklahoma, in Comanche County. Six additional larvae of *P. elongatus* were collected as follows: White River National Wildlife Refuge, Arkansas County, Arkansas, pitfall traps in grassland, 9 June 1969(1); 9 July 1969(1), 28 July 1969(1); 27 August 1971(1); same locality, hand collected, forest duff 13 September 1971(1); Fayetteville, Washington County, Arkansas, hand collected, soil in a flower bed 4 June 1971(1).

*A. punctiformis* was collected at Pickens, Desha County, Arkansas, where 35 larvae were collected in a field which had soybeans the previous summer. The upper 2 to 3 inches of soil was turned, and larvae were easily found. These specimens were collected on the following dates: 2 February 1971(4); 4 March 1971(24); 13 March 1971(7). Eight larvae from the 4 March collection and 2 larvae from the 13 March collection were reared to adults.

Fourteen *C. prasinus* larvae were collected on the shore area of Lake Wilhelmina in Polk County, Arkansas, on 16 September 1970. During the day larvae were collected under rocks near the shore line. A head light was used to collect at night in the same area when the larvae were active on the open ground. Three larvae were reared to adults.

#### REARING PROCEDURES

*A. punctiformis* and *C. prasinus* were reared in 2 oz salve tins containing a small amount of soil (Dogger & Olson, 1966). *P. elongatus* was reared in an 8 oz plastic butter container with 1 inch of soil in the bottom. The 2 oz tins were too confining for the large *P. elongatus* larva. Larvae of the yellow mealworm, *Tenebrio molitor* L., were used as a food source.

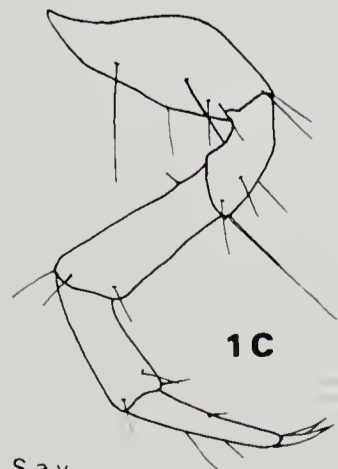
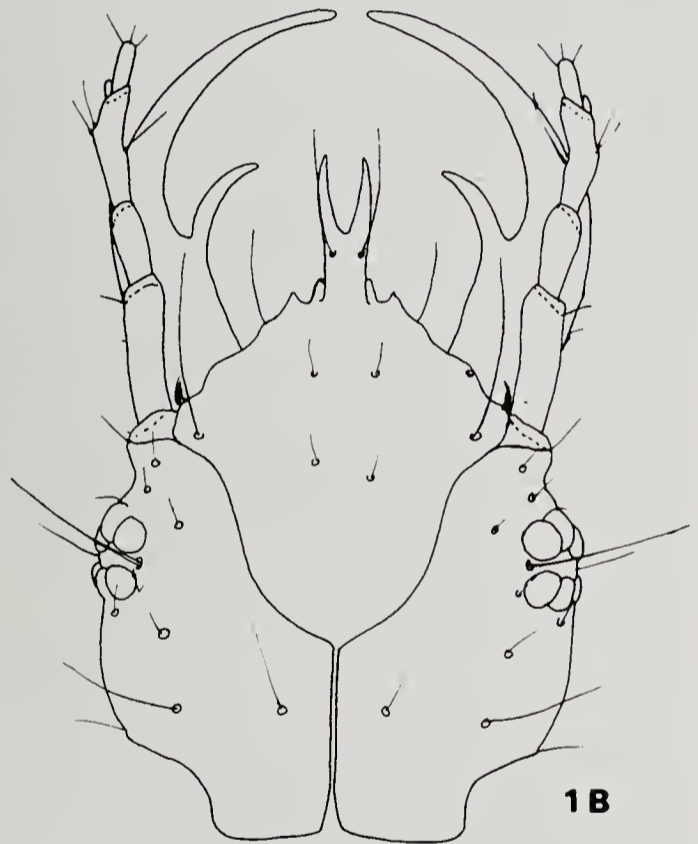
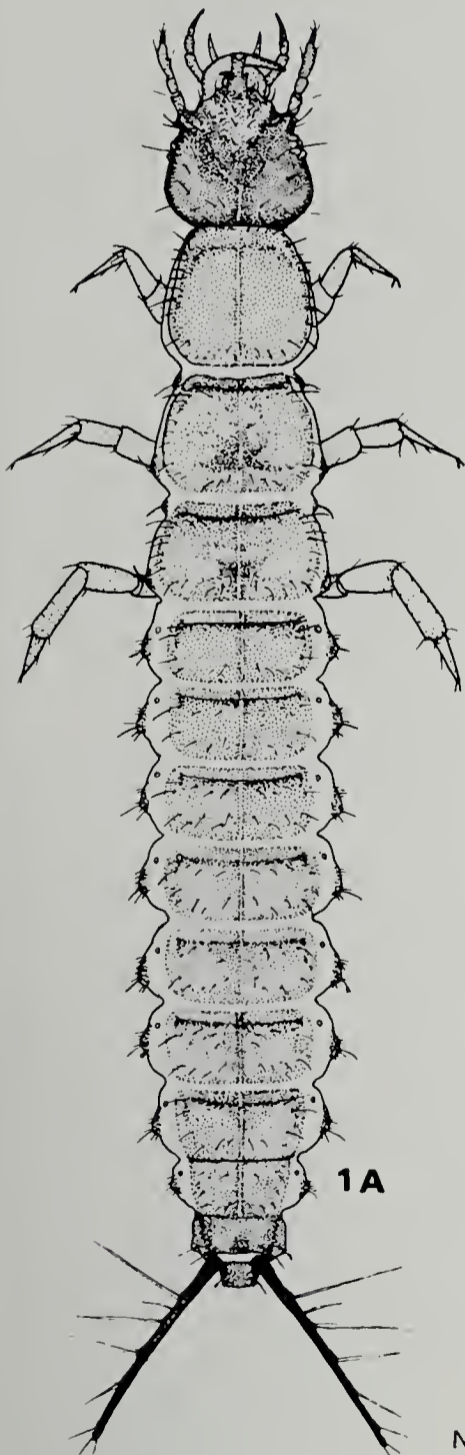
#### DESCRIPTIONS

##### *Notiophilus novemstriatus* Say (Fig. 1A, 1B, 1C)

**GENERAL DESCRIPTION** (Fig. 1A): Mature larvae small, ranging 6.0 to 8.5mm. Head oval, dark brown to black, thoracic tergites similarly pigmented. Legs yellow to white. Neck constricted. Middle segments of abdomen widest. Cerci articulating, black, short, diverging, with setiferous nodes. Mandibles long, yellow, curved distally with large curved retinaculum. Nasale a large central projection with a pair of diverging teeth on apex. Abdominal tergites darkly pigmented. Abdominal sternites lightly pigmented with posterior areas membranous and white. Antennae yellowish to white with base of article I black, article II uniformly brown, article III brown becoming darker distally, article IV uniformly dark brown.

**HEAD** (Fig. 1B): *Antennae* subequal in length to mandibles. Article I subcylindrical, 0.33 longer than article II, subequal to article III and glabrous except for a dorsolateral seta on distal end. Article II glabrous, club-shaped,

subequal to article IV. Article III narrow at base, bearing sensory nodes distally and encircled near middle by 3 prominent setae. Article IV cylindrical, truncate apex encircled with prominent setae, apex with minute setae. *Mandibles* slender, sharp, approximately 5 times longer than basal width, distal 0.66 strongly curved, bearing a small lateral seta; ventral bases yellowish-white. Retinaculum slender, sharp, longer than basal width of mandible, curving sub-parallel with mandible. *Maxillae* yellowish-white, widely separated, pointing ventrolaterally. Stipes slightly club-shaped, prominent seta located distally opposite to outer lobe. Inner lobe absent, replaced by a strong prominent seta adjacent to its normal position. Outer lobe small, 2 articles. Article 1 short and globose; article 2 is 3 times as long as article 1, apex acute. *Labium* equilateral, ventral and lateral aspect sclerotized with dark brown pigmentation, dorsal aspect membranous, white, bearing a prominent seta at base of palpiger. Labial palpus, 2 articles, glabrous, pointing ventrally, usually dark brown, ultimate segment almost black. Article 1 short, stout, subcylindrical, equal to width of antennal article I. Article 2 long, slender, tapering to an acute apex and equal to ultimate article of maxillary palpus,



*Notiophilus novemstriatus* Say

bearing 2 dark brown diverging setae. *Nasale* extending forward obscuring medial mouth appendages (labium and most of stipes), rounded, a large central bifurcate horn, a pair of small sharp teeth located ventrally at base of horn on each side. A pair of teeth, subequal in length located ventrobasally, but slightly laterad to the previous pair. Two setiferous nodes located on anterior edge between base of antennae and first tooth. Distal node small, adjacent to base of tooth, bearing fine setae. Second node quite large, much broader than secondary teeth, bearing a prominent seta directed anteriorly which become finer in last instar. The base of the bifurcate horn bears a pair of setae located laterally. *Adnasale* bears a prominent seta at the anterior angle of the frontoclypeal plate adjacent to antennal base. *Fronto-clypeal plate* slightly convex, sloping from medial ridge to sides, black, fading to yellowish-brown anteriorly, short, not reaching hind margin of head capsule, leaving the *ecdysial cleavage line* long and well developed. Cervical groove absent. Head capsule constricted caudally, 0.5 width of head. Setal pattern of head shown in Fig. 1B. *Eyes* composed of 6 subequal ocelli arranged in 2 transverse arcs of 3 ocelli each. Dorsal ocular seta large and located nearer anterior arc; ventral seta smaller, located more or less centrally at ends of arcs, not visible dorsally. THORAX: *Prothoracic shield* oval, dark brown to black, with a lighter band across posterior 0.20, bearing numerous prominent setae on lateral margin from posterior angle to near middorsal line, small patch of sparsely separated setae near middorsal line just anterior to posterior band. *Middorsal line* distinct on all tergites. *Meso-* and *metathoracic tergites* dark pigmented with lighter band on posterior 0.25. Setal patterns similar to prothoracic tergite except setae on anterior aspect lacking. Anterior margin of mesothoracic tergite slightly arched. *Prosternite* crescent-shaped, lightly pigmented, curving around ventral "neck" region, bearing a pair of prominent setae on anteromedial aspect. *Episternite* of pro- meso- and metathoraces rectangular with lateral coxal articulations and bearing setae. *Mesosternite* oval, lightly pigmented, bearing 2 prominent setae posteriorly. Two small circular sclerites bearing a single seta each located near anteroventral junction of meso- and metathoraces, anterior to sternites and lateral to midline. *Metasternite* larger than mesosternite, both oval, lightly pigmented, bearing 2 pairs of setae. One pair located laterally near middle of sternite; other pair located posteromedially. *Legs* short (Fig. 1C), lightly pigmented, becoming darker toward ends. *Coxa* of prothorax lightly pigmented. *Meso-* and *metathoracic coxae* dark brown except for yellowish to white in distal 0.33. *Mesothoracic spiracle* large with circular black peritreme.

ABDOMEN: *Abdomen* increasing in width from segment I to segment IV or V then decreasing to ultimate segment. *Tergites* subequal in width and length except tergite of segment I narrower and shorter. Setal pattern similar in segments I-VIII with a line of prominent setae on lateral margin and across posterior margin, just anterior to light band on each tergite. *Spiracles* on abdominal segments small with circular black peritremes. *Epipleurites* (Fig. 3D, ep) of segments I-VIII dark brown to black lobes bearing 2 prominent setae located transversely on the obtuse apexes among numerous lesser setae. *Hypopleurite* (Fig. 3D, hp) elongate, 0.33 the length of segment, rounded anteriorly and posteriorly, bearing 3 prominent setae, 2 posteriorly, 1 anteriorly. *Lateral postventrite* (Fig. 3D, lpv) divided; posterior section 5 times larger than anterior section and typically bearing 4 setae while anterior section bears 1. Anterior section often lacking in segments VII and VIII. *Medial postventrite* (Fig. 3D, mpv) subrectangular, typically bearing 2 setae.

*Ventrite* (Fig. 3D, ven) large, ovular, bearing 4 prominent setae transversely at middle and 2 lesser setae near posterior edge. Ventral abdominal sclerites brown to dark brown. Ventrites of segments VIII and IX fused with lateral medial postventrites. Setal pattern same as previous segments. Segment IX bearing a pair of articulating, black, diverging *cerci* subequal in length to the 3 thoracic segments combined. *Cerci* taper slightly to obtuse apices, bearing 8 to 9 setiferous nodes with a seta on each. Five conspicuous nodes on the length of each cercus and 3 lesser nodes encircling extreme apex which may bear 2 to 3 minute setae. Tenth segment stout, truncate, subconical, membranous on lateral aspects, terminating with a large anal orifice. Anal crochets absent.

COMMENTS AND COMPARISONS: Lindroth (1969) reported that of the 14 species of *Notiophilus* known from North America the larvae of 2 species (*N. aquaticus* and *N. biguttatus*) had been described. The larvae of both species were described and illustrated by Schiodte (1867).

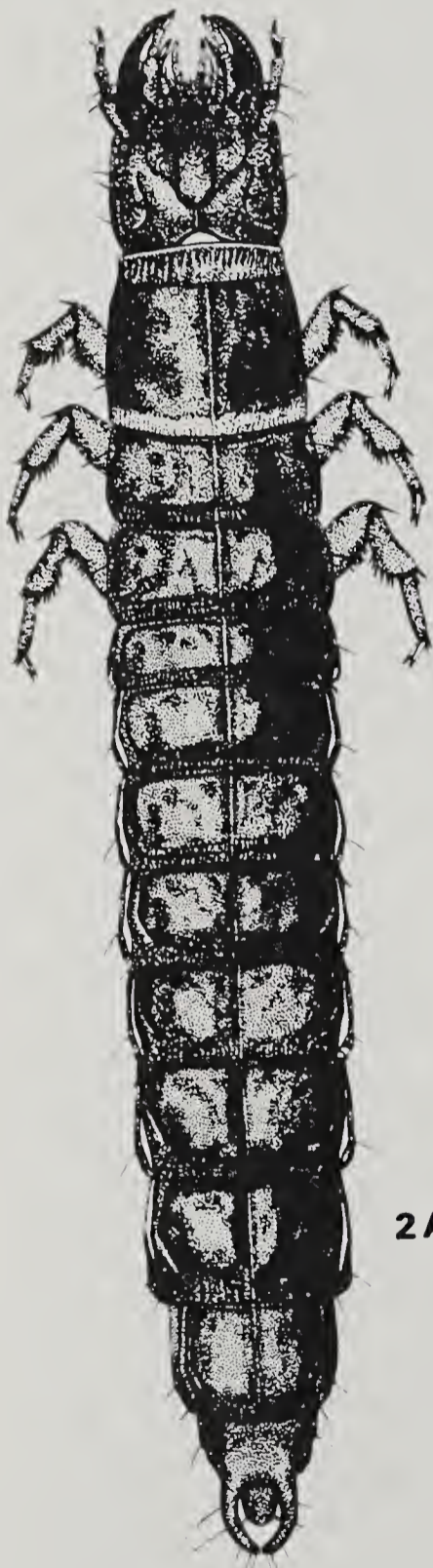
Translation of these descriptions was not available, but illustrations of *biguttatus* were fairly complete, although only the *cerci* were illustrated for *aquaticus*. We utilized these illustrations for comparative purposes. In *aquaticus* the *cerci* are divergent in the basal 0.5 and subparallel distally. In *biguttatus* and *novemstriatus* the *cerci* are divergent their entire length. The general appearance of *biguttatus* presented by Schiodte is very similar to *novemstriatus*. The only obvious difference is the presence of 4 large dorso-lateral depressions on the frontoclypeal plate of *biguttatus* (lacking on Van Emden's [1942] illustration of same). These depressions not present on *novemstriatus*. The illustration of the head (dorsal view) of *biguttatus* by Van Emden (1942) has several features comparable to *novemstriatus*. On close examination, a number of subtle differences appear: 1) the eyes of *biguttatus* appear considerably smaller than *novemstriatus*; 2) *biguttatus* bears 2 setiferous nodes on the anterolateral edge of the nasale, *novemstriatus* only 1; 3) the nasale of *biguttatus* is not as produced as in *novemstriatus*; 4) the teeth at the base of the "horn" are more produced in *biguttatus*; 5) the setal arrangement on the head of the 2 species is different.

*Pasimachus elongatus* Leconte  
(Fig. 2A, 2B, 2C)

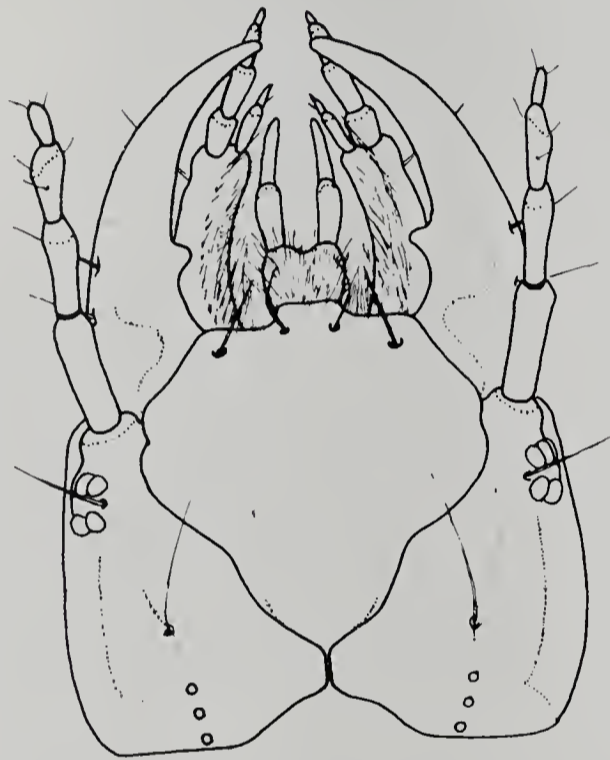
GENERAL DESCRIPTION (Fig. 2A): Mature larvae large, ranging 40 to 50 mm. Head trapezoidal, dark reddish-brown to black, typically darker than thoracic tergites. Legs short, stout, reddish-brown. Neck not constricted. Thoracic segments normally widest. *Cerci* dark reddish-brown, shorter than segment X, curving ventrally, converging distally. Mandibles moderately long, coloration as head, moderately curved, retinaculum small. Nasale blunt. Abdominal tergites covering entire dorsum, contiguous, reddish-brown, margined laterally and posteriorly darker reddish-brown to near black. Antennae shorter than mandibles, 4 articles, same coloration as head with distal ends of each article typically membranous white.

HEAD (Fig. 2B): *Head capsule* slightly wider than long, excluding mandibles, total length slightly longer than prothorax, caudal width subequal to anterior width of prothoracic sclerite. *Antenna* of 4 articles; reddish-brown, total length less than mandibles. Articles I and II glabrous, subequal in length. Article I subcylindrical, sometimes margined distally with a membranous band of lighter reddish-brown to white. Article II club-shaped, distal end with light membranous band, noticeably shorter than article I and II, bearing 3

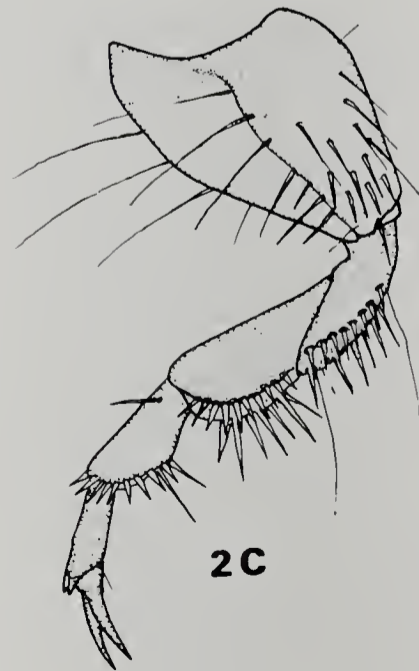
prominent setae, 1 on each lateral aspect on distal 0.33, third seta middorsal behind middle. Article IV club-shaped, 0.33 length of article II, distal end light, encircled with 3 prominent setae, a minute seta often on extreme apex. Bands of very light color on distal ends of articles become darker in latter stage of third instar, also true of other segmented head appendages. *Mandibles* slightly curved, rather heavy, black at apex and dark reddish-brown at bases. *Retinaculum* small, blunt, located behind middle. *Mandibles* bearing 2 prominent lateral setae; a short stout seta on base, a longer stout seta behind middle, even with proximal slope of retinaculum. *Labial palps* reddish-brown, 2 articles, situated on a slightly darker Y-shaped base. Base densely covered dorsally by long fine setae with no evident pattern, all projecting forward.



2A



2B



2C

Ventral side glabrous except for 2 prominent lateral setae just past middle. Articles of palpus glabrous, subequal in length. Article 1 club-shaped with distal end lighter. Article 2 cylindrical, slightly enlarged midway, distal 0.33 sloping to truncate apex. *Maxillary* stipes long, curved, converging distally, with numerous lines of long fine setae on dorsal side running entire length from dorsal midline to lateroventral, 2 long, heavier setae present on distal ends on ventrolateral edge (often obscured by dense fine setae). Maxillary palpi of 4 articles, reddish-brown with light bands on distal ends of articles 1 to 3. Article 1 short, slightly more than 0.5 the length of article 2 with 1 long, stout seta near ventral base. Article 2 longest of the 4, glabrous, club-shaped. Article 3 is 0.75 length of article 2, only slightly clubbed, glabrous. Article 4 conical, truncate, glabrous, 0.25 length of article 3. Inner lobe slightly smaller than article 4 of maxillary palpi, bearing a long stout seta located in distal lighter band. Inner lobe seta seen dorsally but lobe obscured by long setae. Outer lobe of 2 articles, uniformly reddish-brown. Article 1 club-shaped, subequal in length to article 3 of maxillary palp with light band on distal end. Article 2 conical, curving medially, sometimes slightly lighter toward apex, bearing a short stout seta directed dorsally on medial margin near base. Nasale smooth, rectangular, projecting forward approximately 0.33 its width, area directly behind nasale concave. Laterally, to either side of nasale, a small linear patch of fine setae projects forward from anteroventral edge. Frontoclypeal plate 2.3 to 2.8mm maximum width, 2.6 to 2.9mm maximum length, not reaching hind margin of head capsule, *ecdysial cleavage line* short, bearing 4 prominent setae, 2 lesser setae near basal corners of nasale, each in a deep pore; 2 lesser setae even with midline of mandibular bases. Two subparallel grooves at apex of plate extend anteriorly to a point approximately even with ocular setae. *Eyes*, 6 ocelli located laterally, arranged in 2 transverse arcs with distal arc situated slightly more dorsal than proximal arc. *Ocular seta* situated between the most dorsal ocelli of each arc. Ocelli in distal arc nearly contiguous with ocelli in proximal arc widely spaced, separated by more than 0.5 diameter of most dorsal ocellus. *Cervical groove* extends 0.66 the distance across head, intersecting *inner dorsolateral furrow* at sides which extend anteriorly from near hind margin of head capsule stopping even with ocular setae. Caudal portion of inner dorsolateral furrow shallow, sometimes incomplete, appearing as a line of punctures often containing very short setae, with a single prominent seta located in each furrow at 0.5 its length. *Outer dorsolateral furrow* slightly curved, extending from cervical groove to medial edge of proximal ocellus. Ocular setae appearing contiguous with outer furrow.

THORAX: *Meso-* and *metatergites* margined anteriorly, with medial longitudinal line prominent. Prothorax as long as meso- and metanota combined, dark reddish-brown, coloration similar to head. Anterior edge of mesonotum curved with cephalad-projecting anterolateral corners. Pronotum with membranous band of lighter pigment on anterior and posterior edges. Extreme lateral margins of pronotum bearing a single prominent seta in caudal 0.33. Meso- and metanota bearing a prominent seta on lateral margins in anterior 0.33, slightly more dorsal than pronotal seta. *Mesothoracic spiracle* large, approximately twice the size of first abdominal spiracle, 3 times the size of typical abdominal spiracles. All *spiracles* oval with black peritremes located latero-cephalo-ventrad to dorsal tergites. *Legs* as in Fig. 2C. No sclerotized sternites present on meso- or metathoracic segments. Anteroventral margin of

prothoracic segment covered by a large convex triangular sternite (apex directed caudally), bearing a pair of prominent setae, contiguous with small subtriangular sclerites laterally. Lateral sclerites bearing a single prominent seta.

ABDOMEN: *Tergites* of abdominal segments heavily sclerotized, dark reddish-brown to near black on terminal segments. Segments I-VIII margined anteriorly and laterally with a dark band across posterior 0.25, bearing a prominent seta at intersection of lateral margin and posterior band. Abdominal segment I noticeably shorter than segments II-VIII. Segments II-VII uniform in width but length increases with each from anterior to posterior. Segment VIII noticeably longer, narrower and darker than previous segments. Segment IX almost black, narrower than segment VIII, bearing a pair of unarticulating cerci. Each abdominal segment I-VIII bearing 2 darkly pigmented, heavily sclerotized, linear pleurites ventrolaterad, one long, the other short. Short sclerite, located dorsocaudally to larger sclerite, separated by a membranous suture bearing a prominent seta. Ventrally, abdominal segments I-VII covered by 7 lightly pigmented sternites. Sides enclosed by single linear subrectangular pleurites (*epipleurites*) bearing a prominent seta in posterior 0.33. Another linear pleurite (*hypopleurite*) located more ventral, 0.66 length of most lateral sclerites, bearing a prominent seta. Large disk-like ventrite bearing fine seta on anterior lateral edge midventrally. *Median postventrites* and the *lateral postventrites* located posterior to ventrite, separated by a narrow suture. Segment VIII possesses 3 sclerites ventrally, lateral sclerites similar to previously described sclerites, midventral area covered by fused ventrite and postventrites bearing 2 setae caudolaterad. Segment IX appearing covered entirely by a single sclerite bearing 2 setae in same positions as previous segment. Segment X cone-shaped with large anal opening surrounded by a few heavy setae, a pair of small finer setae corresponding to the pair previously mentioned on segment IX present midventrally in middle of segment. Cerci smoothly cylindrical, parallel for basal 0.5, gently curving ventrally, distal 0.5 converging. Distal ends of cerci contiguous or nearly so, shorter than segment X. Each cercus glabrous ventrally, but dorsally bearing 5 prominent setae on its length.

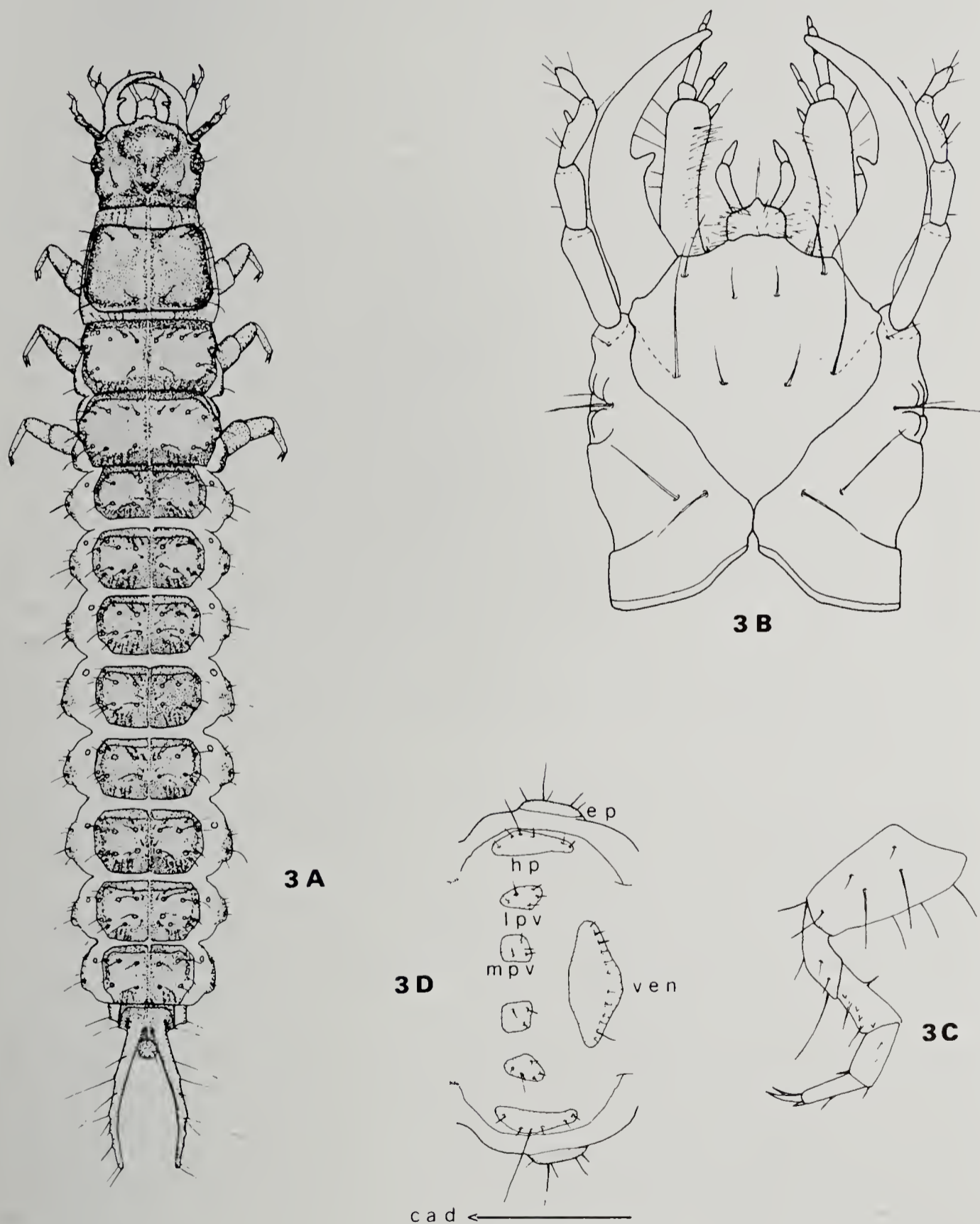
COMMENTS AND COMPARISONS: No complete larval description for species of *Pasimachus* has previously been reported in the literature. A description of the genus presented by Van Emden (1942) developed from unidentified *Pasimachus* larvae fits *P. elongatus* with only one exception. He described the hypoventrite without setae. *P. elongatus* bears a prominent seta. The illustration and comment on the nasale of *P. elongatus* made by Kirk (1972) agree with our diagnosis.

*Agonum punctiformis* Say  
(Fig. 3A, 3B, 3C, 3D)

GENERAL DESCRIPTION (Fig. 3A): Mature larvae small, ranging 8.0 to 12.2mm. Head capsule rounded, dark brown, appendages lighter brown. Pronotum dark brown to near black. Legs light brown to yellow. Abdomen wider than head or prothorax. Cerci nonarticulating, short, diverging slightly to parallel toward ends, bearing setiferous nodes. Nasale slightly projecting typically bearing 5 blunt teeth. Abdominal tergites, pigmented in shades of brown, transversely ovate, not contiguous in mature larvae. Antennae uniform light brown with light membranous bands at joints, shorter than mandibles.



HEAD: (Fig. 3B): *Head capsule* wider than long, excluding appendages, slightly constricted at base to form a broad "neck", narrower than pronotum, pigmented slightly lighter, measuring approximately 0.9mm long and 1.1mm wide. *Antennae* subequal to mandibles, light reddish-brown, of 4 articles. Article I cylindrical, lighter on distal end, 0.75 as long as articles II and III combined. Article II slightly club-shaped, lighter on distal end, subequal in length to article III. Article IV short, 0.5 length of article III, apex lightly pigmented, encircled with 3 setae and 1 minute seta on extreme apex. *Mandibles* 0.75 length of head capsule, more than 3 times longer than basal width, sharply curved, reddish-brown, with a prominent seta on basal 0.25. Re-



*Agonum punctiformis* Say

tinaculum prominent at inside base of each mandible. *Maxillary* stipes long, cylindrical, 0.66 length of antennae, curving inward distally. Seta on stipes sparse and fine dorsally and ventrally, with a few prominent setae on lateral edges. Inner lobe very small node, bearing a prominent seta on apex. Outer lobe of 2 articles, glabrous. First article subequal in length to antennal article IV, slightly club-shaped, lighter on distal end. Article 2 cylindrical, rod-like, apex truncate. Maxillary palpus of 4 articles, articles 2 to 4 glabrous, subequal in length to antennal articles III and IV combined. Article 1 globose, glabrous dorsally, a single stout spine ventrally, 0.5 length of article 2. Article 2 slightly clubbed, lighter in color on distal end. Article 3 subcylindrical, subequal in length to article 2. Article 4 short, 0.5 length of article 1, cone-shaped, tapering to a blunt apex. Base of *labium* rectangular with numerous long setae laterally and dorsally. Ventral surface glabrous except for a prominent seta at base of each labial palpus. Labial palpi of 2 articles. Article 1 clubbed, subequal in length to antennal article I, glabrous. Article 2 is 0.66 length of segment 1, conical, tapering to an acute apex, glabrous. Ligula node-like, centrally located on distal end of labium, bearing 2 setae contiguous at least on distal ends. Nasale centrally enlarged, bearing 2 large blunt teeth medially often notched, with a small sharp tooth on lateral aspect of each. Lateral teeth generally shorter than medial teeth. *Frontoclypeal plate* concave in anterior 0.33 with 2 prominent setae on a line between eyes, 2 lesser setae on adnasale areas. Frontoclypeal plate not reaching hind margin of head, *ecdysial cleavage line* well developed but short. Medially converging grooves on lateral edges of plate near antennal bases, short and shallow. *Eyes* composed of 6 ocelli located laterally, arranged in 2 transverse rows. Anterior row small, in a straight line with the posterior row strongly arched. Ocelli slightly larger in posterior row, with a prominent seta located dorsolaterally between the 2 rows, a lesser seta located ventrolaterally directly under end of anterior row. *Cervical groove* short, curved, beginning ventrolaterally, tapering to a shallow furrow dorsally to give the impression of a "neck" constriction with 2 pair of prominent setae and a pair of lesser setae located just anterior to and parallel with constriction. Lesser pair located more medially. *Ocellar furrow* present laterally, extending dorsally, terminating at top of posterior row of ocelli. Hind margin of dorsal head capsule deeply notched centrally at ecdysial cleavage line.

**THORAX:** Pronotum with marginal groove entire, meso- and metatergites with marginal groove anteriorly and laterally, with *middorsal longitudinal line* prominent. *Prothorax* 0.75 as long as meso- and metathoraces combined, slightly narrower, pigmented darker than either. Prominent setae numerous on prothoracic shield, a number of setae located on anterolateral corner and few sparse setae around entire margin. Meso- and metatergites subequal in width, length, and pigmentation, (mesonotum slightly darker anteromedially) with anterior margin of mesonotum more concave. Setal pattern same on both segmental sclerites (i.e., 6 prominent setae inside of and parallel to marginal groove). Smaller setae fairly numerous on each tergite with a small patch dorsal of anterolateral corner, a line of setae across anterior edge parallel and posterior to marginal groove and across posterior of tergite (with fewer setae here). Setal patterns similar on all abdominal tergites. Prosternite subtriangular, heavily sclerotized, darkly pigmented. *Legs* short (Fig. 3C), appearing weak, lightly pigmented. Coxae subconical with a concave surface extending the length of lateral aspect. Meso- and metathoracic segments each bearing 3 lightly sclerotized sternites. Each lateral sclerite bearing 2 short setae aligned

longitudinally; a delicate seta anteriorly, a stouter 1 posteriorly. Ventricle oval, bearing 2 prominent setae aligned transversely on lateral aspects. Pleurites on meso- and metathoracic segments subtriangular, each bearing a prominent seta and lesser seta. *Mesothoracic spiracle* about 2 times the size of spiracle on abdominal segment I, peritreme lightly pigmented.

**ABDOMEN:** Abdominal membrane white to yellowish white. Tergites dark brown to tan. First abdominal segment slightly larger than metathoracic segment. Tergites of abdominal segments I-VIII margined anteriorly and laterally, pigmented in shades of brown, with numerous setae. Setal pattern is 2 transverse lines of setae; first, from posterior to anterior margin extending past lateral margin to lateral edge; second with fewer setae near posterior margin of sclerite. Segments II-V subequal in size. Segments VI-VIII becoming progressively smaller with tergites becoming more circular. Spiracles 2-8 smaller than spiracle 1. *Epipleurite* simple, subcircular to linear with rounded anterior ends, tapering posterior ends, with 5 prominent setae; typically 2 on anterior end (often only 1 on abdominal segment I), 2 slightly behind middle, 1 on posterior tapered area. *Hypopleurite* linear, usually same length as entire segment with 7 setae; 3 setae anteriorly (1 on abdominal segment I, often 2 on abdominal segments II and VIII), 3 setae near middle of sclerite (1 on segment I, often 2 on segment VIII), 1 on posterior ventral edge. *Ventricle* rhombic with a row of prominent and lesser setae aligned transversely between lateral apices, a pair of prominent setae on posterior border on each side of midline. *Lateral postventrites* on I-VII trapezoidal, bearing a prominent seta and typically 5 lesser setae. *Medial postventrites* square, bearing a prominent seta and typically 3 lesser setae. Ventricle and postventrites appear fused on segment VIII with setal arrangement essentially the same as typical segment. General arrangement of prominent setae on typical tergites aligned in 2 transverse lines anterior and posterior. Segment VIII modified slightly. Segments IX and X highly modified. Segment X an *anal tube*, sclerotized dorsally and ventrally, separated laterally by a membranous strip for its entire length. Prominent setae present in approximately the same pattern dorsally and ventrally as typical segments. Anal crochets absent. Length of anal tube subequal to length of abdominal segment VIII. Nonarticulating *cerci* on segment IX pigmented lighter than other dorsal sclerotized areas, subequal in length to abdominal segments VII and VIII combined, each tapering to a moderately blunt apex with setiferous nodes bearing prominent setae (typically 9) which point all directions except medially.

**COMMENTS AND COMPARISONS:** According to the available literature, the larvae of 7 species of North American *Agonum* are known (Lindroth 1969): *extensicolle* (Schaupp, 1881, Dimmock and Knab, 1904), *decorum* (Dimmock and Knab, 1904), *ruficorne* (Kemner 1913), *mannerheimi* (Saalas 1917), *muelleri* (Larson 1941), *thoreyi* (ibid.), and *consimile* (Lindroth 1955). Descriptions were attempted for only a few. Most of these were very brief and/or translations were unavailable. We were unable to secure the descriptions of *ruficorne* by Kemner (1913) and *mannerheimi* by Saalas (1917). The description of *extensicolle* by Schaupp (1889) was very general, and the illustrations (located in a separate publication) were extremely diagrammatic. It would be virtually impossible to make a definitive identification on a field collected larva of *extensicolle* with this description. Comparisons could not be made with *extensicolle*, *decorum*, and *mannerheimi*. A limited number of comparisons were possible with *muelleri*, *ruficorne*, *thoreyi*, and *consimile*.

The nasale of *thoreyi* and *consimile* is not as produced as in *punctiformis*.

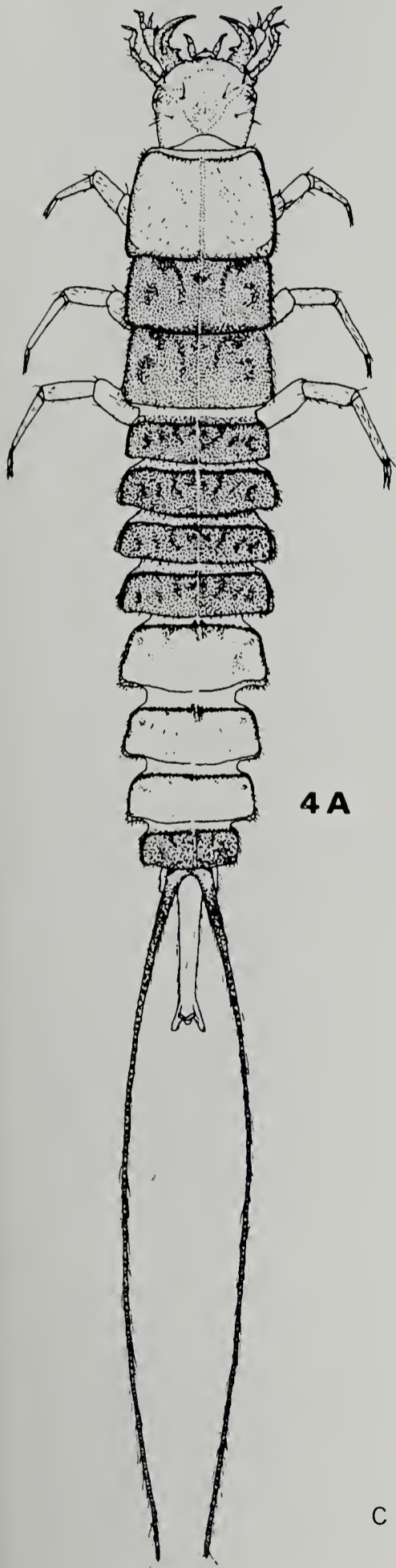
They also appear to bear a pair of medial sharp teeth which are blunt in *punctiformis*. The leading edge of nasale is serrate in *thoreyi* and *consimile* but lacking in *punctiformis*. The nasale of *muelleri* and *punctiformis* is produced but serrulate only in *muelleri*. The nasale is minutely serrulate in *ruficorne*. The mandibles are notched or serrate anterior to the retinaculum in *thoreyi* and *consimile* but not in *punctiformis*. Article 1 of the maxillary palpus bears a seta which is lacking in *punctiformis*. Article 3 and 4 of the maxillary palpus of these same species bear setae (1 on article 3 and 2 to 4 encircling apex of article 4) which are lacking in *punctiformis*. Kirk (1972) illustrated and described the nasale and adnasalia of *A. placidum*. The prominent teeth of the nasale of *placidum* are lacking in *punctiformis*. The adnasalia areas are similar.

*Chlaenius prasinus* Dejean  
(Fig. 4A, 4B, 4C)

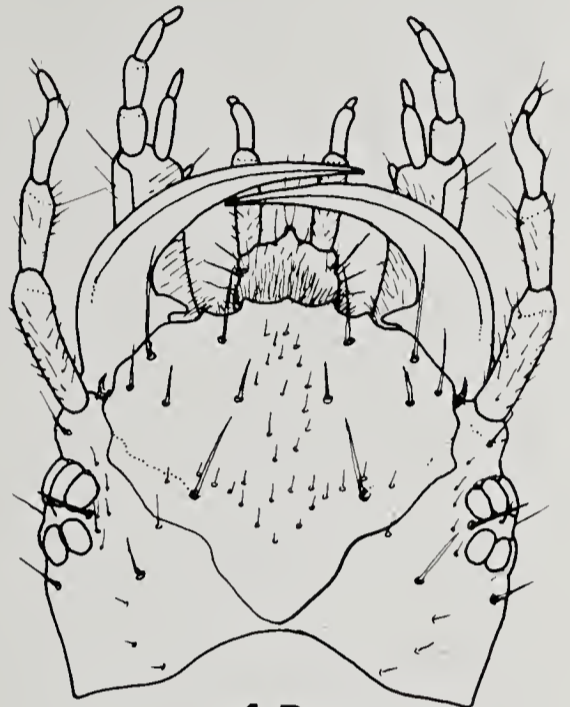
**GENERAL DESCRIPTION** (Fig. 4A): Larvae of medium size, cerci long, equal in length to body. Mature larvae ranging 25 to 30mm, including cerci. Pigmentation distinctive with head and prothorax yellow to yellowish-brown, remaining thoracic segments and first 4 abdominal segments dark brown to black, abdominal segments V-VII white to light tan, abdominal segments VIII and IX including cerci brown to dark brown. Eyes black. Tergites covering entire dorsal surface and projecting laterally. Prothoracic shield wider than head and broadly joined at "neck". Body uniform in width, tapering from abdominal segments VI and VII. Legs long, slender, usually pigmented same as head and prothorax.

**HEAD** (Fig. 4B): *Head capsule*, excluding appendages, equilaterally trapezoidal. Total length of head and appendages subequal to length of prothoracic shield. Width across eyes subequal to prothoracic shield length. *Antennae* of 4 articles, article I long, nearly twice the length of II, straight, sides parallel, cylindrical, bearing numerous small setae with stouter setae on medial aspects. Article II short, 0.75 length of III, slightly club-shaped, bearing numerous small setae with stouter setae on medial surface, a prominent seta mediodistally. Article III 0.66 length of segment I, curving medially, slightly larger anteriorly, bearing sensory nodes, setae present on mediodistal aspect, a prominent seta mediolaterally. Article IV club-shaped, 3 to 4 prominent setae encircling obtuse apex. *Mandibles* strongly curved, sharp, slightly concave medial aspect from retinaculum to apex. Retinaculum acute apically, directed slightly posteriorly with mandibles closed. Mandibular base wide dorsally but width less than 3 times length, small seta on lateral margin opposite retinaculum and a small group of minute setae basolaterally, otherwise glabrous. *Pencillicus* present on dorsomedial base. Stipes long, sides subparallel, ventral and lateral aspects sclerotized while dorsomedial surface membranous, bearing numerous rows of long fine setae which become robust and prominent distally. Lateral sclerotized area bearing numerous lesser setae, with 2 more prominent setae; 1 distally and 1 medially. Inner lobe distinct, slender, obtusely cone-shaped apex bearing a prominent seta, 0.5 length of ultimate antennal article. Outer lobe of 2 articles. Article I 0.66 length of antennal article II, cylindrical, glabrous except for a prominent seta on ventral surface anterior of middle. Article 2 conical, tapering to an acute apex, glabrous, subequal in length to ultimate antennal article. *Maxillary* palps of 4

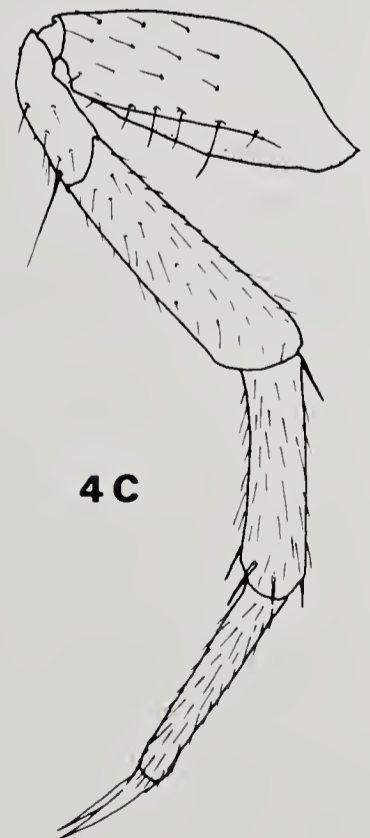
articles, article 1 short, globular, bearing a prominent seta ventrally, smaller dorsal setae on distal end. Article 2 slightly club-shaped, robust, glabrous, subequal to ultimate antennal segment. Article 3 subcylindrical, more slender than articles 1 and 2, subequal in length to ultimate segment of outer lobe. Article 4 obtusely conical, short, glabrous, subequal to width of article 3. *Labium* rectangular, membranous dorsally, sclerotized ventrally, densely



4 A



4 B



4 C

*Chlaenius prasinus* Dej.

covered with long fine setae basally and basolaterally with setal tufts. Setae larger and more prominent around palpigers dorsally, ventrally glabrous except for a prominent seta at base of each palpiger. Ligula obtusely conical, subequal in length to penultimate article of maxillary palps, bearing 2 prominent setae apically, parallel, often becoming contiguous distally. Labial palpi 2 articles with a sensory node appearing as a third segment. Article 1 slightly club-shaped, long, subequal in length and similar in shape to antennal article II but more robust, bearing long setae over its entire length which becomes more prominent distally. Sensory node robust and obtusely conical, glabrous, subequal in length to ultimate antennal segment. *Nasale* equipped with 4 to 7 teeth; typically 4 large sharp teeth (a pair on each side of mid-line) often with a small central tooth, seldom with a very small tooth between laterally located large teeth. *Adnasale* lobes project anteriorly, slightly shorter than large teeth. *Frontoclypeal plate* large, covering most of head dorsally, almost reaching hind margin of head capsule, *ecdysial cleavage line* short, not well-developed. *Eyes* comprised of 6 ocelli arranged in 2 transverse arcs. Intraocellar area black, bearing 4 setae; a prominent seta at each end of arcs dorsally and ventrally, 2 lesser setae near middle ocellus of anterior arc. *Ocellar furrow* and *cervical groove* lacking.

**THORAX:** *Pronotum* wide, base wider than apex, overhanging laterally, not appearing heavily sclerotized, with shallow furrows across anterior 0.33 and laterally to near posterior margin. Apex subequal to head width at eyes. Numerous small setae cover entire dorsum, becoming slightly more prominent on posterior and lateral margins, more dense on anterior and posterior apices. *Mesonotum* darker pigmented than pronotum, normally lighter than *metanotum*, twice as wide as long, margined anteriorly and laterally, overhanging laterally, setal pattern similar to pronotum but fewer setae. *Metanotum* subequal to mesonotum but anterior edge less concave, and pigmented darker. *Legs* (Fig. 4C) moderately long, lightly pigmented (almost white), slender. Prothoracic legs stoutest and metathoracic legs longest. *Prosternite* appearing as half a shallow cone with a wide membranous-like band on anterior margin, setae small, sparse. *Episternum* contiguous with coxal articulation and prosternite, bearing sparse small setae, a more prominent seta situated on apex of ventral angle. Sternites of meso- and metathoraces similar, consisting of 5 small sclerites; a large central ovular *ventrite* bearing 2 prominent setae near middle, 2 small setae near anterior edge; remaining 4 small oval sclerites lie laterad (2 anterior, 2 posterior) of ventrite, each lateral sclerite bearing a seta. Ventrite often extends even with most anterior small sclerites bearing at least 4 setae. Lateral postventrites often fused on metathorax. Pleurites produced as lobes under notal plates of meso- and metathoraces projecting past them at posterior apices. *Mesothoracic spiracle* circular with dark pigmented peritreme encircled by a subtriangular sclerite contiguous with base of pronotum and anterior corner of mesonotum.

**ABDOMEN:** *Abdominal tergites* narrower than thoracic tergites, 0.5 length of prothoracic tergite, 3 times wider than long, dark brown pigmented, margined anteriorly and laterally, overlapping lateral margins. Thoracic tergites and abdominal tergites subequal in width making sides parallel, tapering begins at fifth abdominal segment. Abdominal segments I-IV subequal in size, shape, setal pattern. Setal pattern similar to thoracic tergites. Abdominal tergites on V-VII lightly pigmented, decreasing in width and increasing in length, margins dark brown to black. Setal pattern similar to anterior segments, setae more

sparse on dorsum. Tergite of VIII darker pigmented than tergites of segments V-VII, subequal in length, but narrower than segment VII, setal pattern similar to anterior tergites but setae more dense than previous 3 segments. Tergite of IX small, margin darker than remaining tergite, few sparse setae on dorsal aspect and few on lateral aspects, bearing a pair of long articulating filamentous *cerci*. Ninth segment withdrawn under tergite of VIII. Tenth abdominal segment long, subequal to length of ultimate tarsus of metathoracic leg including unguis. Three finger-like appendages present on distal end ventral to anal opening. Appendages subequal in length to antennal segment I, sides parallel, apexes obtusely rounded, covered with numerous minute spines. Abdominal sternites lightly sclerotized, lightly pigmented, bearing numerous small setae. *Hypopleurite* produced on a lobe, pigmented darker than remaining sternites. *Epipleurite* produced on a smaller lobe. Ventricle subovular, large covering most of anteroventral area. *Lateral post-ventrite* shaped subtrapezoidal. *Medial postventrite* fused, forming a rectangular sclerite along posterior margin of segment. *Cerci* of ninth abdominal segment subequal in length to entire body, irregularly annulated, bearing numerous small setae.

COMMENTS AND COMPARISONS: At the present time, 9 additional species of *Chlaenius* larvae have been described; 1) *cumatilis* Leconte, 2) *impunctifrons* Say, 3) *laticollis* Say, 4) *leucoscelis* Chev., 5) *pennsylvanicus* Say, 6) *platyderus* Chaudoir, 7) *sericeus* Forster, 8) *tomentosus* Say, 9) *tricolor* Dejean.

Four species other than *prasinus* were described by Chu (1945); 1) *cumatilis*, 2) *sericeus*, 3) *tricolor*, 4) *pennsylvanicus*. The larva of *pennsylvanicus* and *tricolor* differ markedly from *prasinus* by having short non-annulated *cerci* which bear setiferous nodules. The nasale is quite different in the species mentioned. On *pennsylvanicus* it bears a single broad median tooth and 2 blunt teeth on each side, on *tricolor* it is serrulate medially. The nasale of *cumatilis* and *sericeus* are similar to *prasinus* but differ by the presence of small teeth between the median tooth and the lateral pairs. Also, the body is tricolored in *prasinus* and not in *cumatilis* and *sericeus*. One of the characters used by Chu to separate *prasinus* from *cumatilis* and *sericeus* was the presence of setae on the back of the mandibles (2 in *prasinus*, 4 in *cumatilis* and, 5 in *sericeus*). We found this number to be highly variable in our *prasinus*; always more than 2.

Chu described and figured the larva of what he accepted as *Chlaenius prasinus*. Because of many differences we have observed in our specimens when compared with Chu's description, we feel that it is necessary to redescribe the larva of this species. Chu's identification was based exclusively on the larvae. The larval stadia was not determined and information explaining how measurements were taken was not given.

TABLE I. Measurements (in mm.) of *Chlaenius prasinus* larvae.

	Chu	Thompson & Allen
Head width	2.1	2.1
Prothorax, width	3.3	2.9
Body, length	24.8	21.6
Cerci, length	14.4	15.6
9th abd. seg., length	0.5	0.8
10th abd. seg., length	1.9	2.3

Chu found: head brown, but we found it ochraceous; prothorax brown, we found it slightly darker than the head; abdominal segments 5 to 10 light brown, we found segments 5 to 7 ochroleucus (whitish ochre-yellow), segments 8 and 9 slightly darker than the prothorax; segment 10 ochraceous; legs light brown, we found them as light colored as the head.

All 9 epipleurites were described by Chu as being heavily sclerotized but we found only the epipleurites of segments 1 to 4 heavily sclerotized. He also found all 8 hypopleurites heavily sclerotized as compared with our observation that hypopleurites 1 to 4 were heavily sclerotized and the remainder, lightly sclerotized. He also described the sternites of segments 8 and 9 as being fused into 1 piece on each segment, whereas we found that only the ventral group of sternites fused on segment 8 and on segment 9 the ventral group was fused with the hypopleurite.

Two species, *laticollis* and *leucoscelis*, described and identified by Schaupp (1880) were poorly illustrated. In the descriptions *laticollis* has dark blue thoracic scutes, black abdominal scutes, a light rufous head, the cerci are rufous basally, black in the middle and white at tip and the labrum (nasale) bears 5 teeth. The larva of *leucoscelis* is entirely a deep shining black, a dark red head, cerci dark at the base and the rest fuscous and the labrum (nasale) with the middle tooth bifid.

All stages of *impunctifrons* Say have been figured and described by Claassen (1919). His description reveals numerous differences when compared with *prasinus*. The general body color is dark brownish-black with the head yellowish-brown. The caudal cerci of the third instar larva appear to be about 0.25 length of body which is considerably shorter than cerci of *prasinus*. The habitus of *impunctifrons* is much broader and much shorter than in *prasinus*.

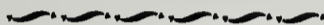
Kirk (1972) described and illustrated the head and nasale of 2 other species and updated this information on a previously described species, all were compared with *prasinus*: 1) *platyderus*, 2) *sericeus*, 3) *tomentosus*. His species and *prasinus* all bear 5 blunt medium-sized teeth on the nasale. The teeth of *prasinus* are more broadly spaced than *platyderus* and *tomentosus* and smaller denticles are not as apparent. The nasale of *prasinus* is generally more similar to *sericeus* but adnasilia are more produced and lateral angles are more acute.

#### LITERATURE CITED

- CHU, H. F. 1945. The larvae of the Harpalinae Unisetose (Coleoptera, Carabidae). Ent. Amer. 25(1):1-71.
- CLAASSEN, P. W. 1919. Life history and biological notes on *Chlaenius impunctifrons* Say. (Coleoptera, Carabidae). Ann. Ent. Soc. Amer. 12:95-101.
- DIMMOCK, G., AND KNAB, F. 1904. Early stages of Carabidae. Bull. Springfield Mus. Nat. Hist. 1:1-55.
- DOGGER, J. R., AND OLSON, C. A. 1966. Larval, characteristics of some North Dakota carabids (Coleoptera, Carabidae). Coleopt. Bull. 20:91-96.
- KEMNER, N. A. 1913. Beitrage zur Kenntnis einiger schvedischen Kolepterenlarven. Ark. Zool. 8:15-23.
- KIRK, V. M. 1972. Identification of ground beetle larvae found in cropland in South Dakota. Ann. Ent. Soc. Amer. 65(6):1349-1356.
- LARSON, S. G. 1941. In: V. Hansen, Sandspringere ug Lobebiller. Danm. Fauna. 47:1-218.



- LINDROTH, C. H. 1955. A revision of the North American species of *Europhilus* Chaud., subgenus of *Agonum*: (Coleoptera, Carabidae). Pan-Pac. Ent. 31:1-14.
- LINDROTH, C. H. 1966. The ground beetles of Canada and Alaska. Part 4. Opusc. Ent. 29:409-648.
- SCHAUPP, F. G. 1880. Description of the larvae of *Chlaenius laticollis*, Say. Bull. Brooklyn Ent. Soc. 3:(3)17-18. Biological notes on the larvae of *Chlaenius leucoscelis*, Chev. ibid., (4) p. 25-26.
- SCHAUPP, F. G. 1881a. Description of the larvae of *Platynus extensicollis*, Say. Bull. Brooklyn Ent. Soc. 3(11):91-92.
- SCHAUPP, F. G. 1881b. Description of the larvae of *Pterostichus lucublandus* and *Pt. mutus* Say. Ibid (10):88-89.
- SCHIODTE, J. C. 1867, 1872. De Metamorphosi Eleutheratorum observations. Naturhist. Tidsskr. (3) 4.8:415-552, 165-226.
- VAN EMDEN, F. 1942. A key to the genera of larval Carabidae (Col.). Trans. Royal Ent. Soc. Lond. 92 (1):1-99; 100 Fig.



OCCURRENCE OF *ERNOBIUS OPICUS* FALL  
IN EASTERN UNITED STATES  
(COLEOPTERA: ANOBIIDAE)

E. J. FORD, JR.

Animal and Plant Health Inspection Service,  
Plant Protection and Quarantine Programs,  
U. S. Department of Agriculture

ABSTRACT

Collection of first known males and new distribution records are presented for *Ernobius opicus* Fall.

---

*Ernobius opicus* was described by H. C. Fall in 1905 from 2 females collected in Michigan and Massachusetts by Hubbard and Schwarz. In 1962, Dr. R. E. White stated that *E. opicus* was very rare in collections, and the male was unknown. I have carefully screened light trap collections for 14 years (1960-1974) and found 6 specimens including 3 males. Collection data are: MARYLAND, Anne-Arundel County, Baltimore-Washington International Airport, 11-VII-67 and 25-VII-67 (2); Baltimore County, 23-VI-66, VI-68, and 18-V-68 (3). PENNSYLVANIA, Cowans Gap, 30-VI-68 (1).

In studying external characteristics I found that the only reliable difference for separation of the sexes is in the structure of the antennae. In the